WATER QUALITY OBJECTIVES WITHIN COOPERATIVE INTERJURISDICTIONAL WATER QUALITY MANAGEMENT

GUMMER, WM. D. JULY 1986

The management of water quality can involve many different approaches and strategies depending on the issues, state of the aquatic resource, and the philosophies of the water resource managers. The role of Water Quality Objectives or variations of these, within water resources management has been increasing throughout the world, becoming accepted in many countries such as Great Britain, Australia, U.S.A. and recently, Canada. The Canadian Council of Resource Environment Ministers (CCREM) has endorsed the development of National Water Quality Guidelines and their application in water quality management in Canada.

There are many examples where water quality objectives are being applied by provincial jurisdictions in support of their water quality management programs, e.g., Manitoba and Stream classification; Ontario; Saskatchewan and the pending development of objectives for the South Saskatchewan River and tributaries; Alberta with its general water quality objectives and British Columbia and their development of site specific objectives. The following discussion deals with the "essence" of water quality objectives and their possible merits within interjurisdictional water quality management, drawing from practical applications within Canada.

Definition of Water Quality Objectives

Water Quality objectives are numerical concentrations or narrative

statements of water quality which water managers have agreed to achieve or maintain in a given water body to protect specific designated water uses. In addition to the traditional approach of establishing chemical concentrations, they may also involve physical and biological considerations of the aquatic ecosystem.

In practice, water quality objectives can provide a rational basis for the development of effluent regulations and approvals under pollution licences or permits. Therefore, objectives can contribute to the reconciliation of the needs of the water user (human and other forms of life) versus those of economic development (industry, agriculture, municipalities . . .).

Principles

The principles underlying the applications, formulation, setting, and adoption of water quality objectives are fundamental to understanding their potential use in water quality management. The following principles can be generally found within the Great Lakes Water Quality Agreement, the CCREM, various IJC References and the Prairie Provinces Water Board.

1. Application (How objectives can be used).

. Objectives are established to protect the most sensitive use thereby providing for protection of all water uses;

- Objectives are minimum targets whenever objectives are better than the existing quality; where the existing quality is better than the objective, this quality should be carefully managed for the perpetuation of designated water uses;

- Water Quality Objectives are not legally binding numbers; they may contribute to the development of standards or effluent regulations but are in themselves no more than statements of intent or guiding values;

- Should an objective be exceeded, this indicates that water resource managers should consider that continued 'excursions' could mean that one or more uses are potentially at risk over the long term; but this depends on the manner in which the numbers have been formulated, whether acute or chronic toxicity may be a concern, the magnitude of the value and so forth such that there may be concerns over the short term;

- In interjurisdictional situations, objectives provide an opportunity for jurisdictions to reach agreement on the quality of water which should be respected at transboundary locations in order to ensure the equitable sharing of the aquatic resource; therefore, objectives negotiated between jurisdictions, can avert interjurisdictional conflicts and clarify the obligations of the jurisdictions involved;

- Objectives provide water developers with environmental impact assessment guidelines;

- Objectives can be environmental indicators which can alert managers to trends well in advance of undesirable conditions;

- Objectives established cooperatively between jurisdictions for transboundary locations rather than at intra-basin locations, respect the sovereignty of the jurisdictions to manage water resources within the basin.

2. Establishing Objectives

- Should be in harmony with the quality of the receiving environment, i.e., site specific, scientific criteria and jurisdictional guidelines;

- Present and foreseeable water uses should be designated so that objectives will be consistent with the evolution of social and economic needs;

- Objectives should be set for only those parameters or conditions which are considered to constitute actual and potential water quality problems;

- Analytical and Monitoring protocols should be identified in support of water quality objectives;

. The scientific information behind each of the water quality objectives must be fully documented;

. Whenever possible, water quality objectives should endorse the ecosystem concept and consider the antagonistic, synergistic and additive effects of substances.

3. Setting (The process of formalizing and adopting objectives)

. Once the objectives have been established, the management agencies should formally adopt the numbers after first reviewing and satisfying themselves that the numbers are consistent with the social and economic needs of the basin, river segment, etc.

. Formal adoption by resource management agencies provide for public endorsement of protecting designated water uses;

. Objectives must be subjected to periodic scientific review on the basis of updated information on ambient aquatic quality, water use criteria, and economic and social values.

PRACTICAL APPLICATIONS OF WATER QUALITY OBJECTIVES

INTERNATIONAL JOINT COMMISSION

RED RIVER AT EMERSON, MANITOBA

The International Joint Commission has five water quality objectives which it has formally adopted for the Red River at the International Boundary near Emerson, Manitoba. They are for total dissolved solids, total coliform, sulfates, dissolved oxygen and chlorides. The purpose of the objectives was to specify the quality of the Red River which was necessary so as to ensure that downstream water uses in Canada would not be harmed (Boundary Waters Treaty, 1909). The objectives provided a target towards which the State and U.S. Federal Agencies agreed to work in order to improve the bacterial, oxygen and salinity quality of the Red River.

In addition, its Red River Pollution Board, composed of state, provincial and federal environmental and pollution control agencies, have developed Water Quality Alert Levels which are essentially pseudo water quality objectives, for approximately forty constituents. The Board is currently investigating ecosystem water quality objectives and the use of biological indicators for this purpose.

The Alert Levels are a monitoring tool, established to alert jurisdictions to potentially undesirable water quality conditions which if exceeded should be considered further in the context of the uses being supported in the Red River Basin downstream in Canada. Where the follow-up investigations reveal that improvements are indeed needed in the U.S.A., the Red River Pollution Board will advance to the IJC for its consideration and recommendation to governments, revised or new water quality objectives, developed on the basis of excursions to the Alert Levels and on the basis of other scientific information. This concept was approved by the IJC for use by the Board commencing in 1985.

AGENCY COMMITMENTS TO WATER QUALITY OBJECTIVES

The governments of the U.S.A. and Canada authorized the Commission to establish continuous supervision of water quality over the quality of waters crossing the boundary in the Red River and to recommend amendments or additions to the objectives when considered warranted by the Commission.

In the event that the Objectives are not being met, the Board notifies the pollution control agency having the jurisdiction, obtains assurance that such pollution will be corrected pursuant to a definite time schedule and informs the Commission of the action taken.

The agencies have agreed to coordinate their effluent releases to avoid undue concentrations of wastes at the boundary particularly during the break-up period of the year when lagoons are frequently drawn down so that the Objectives will be adhered to.

The agencies have agreed to implement through the Board an effective early warning system which relies on the objectives, alert levels, spill reporting and contingency planning.

ACHIEVEMENTS

The objectives have resulted in:

. identification and resolution of water quality issues;

. acted as a deterrent to indiscriminant discharge;

. provided information necessary for pollution control agencies to evoke pollution enhancement initiatives with certain industries;

. securing the cooperation of the agencies involved in pollution assessment of the Red River;

. provided a yardstick with which to measure and report on water quality relevant to water uses in the Basin;

. providing a rational basis for establishing site specific stream and effluent standards in the U.S.A.

INTERNATIONAL JOINT COMMISSION

GREAT LAKES WATER QUALITY OBJECTIVES

As part of the Canada-USA Great Lakes Water Quality Agreement (1978), specific water quality objectives were established for those parameters whose effects on ecosystem health were relatively well documented. General objectives were also included and intended to provide aesthetic or other non-quantifiable protection to the system. The Agreement provided the Parties the flexibility to revise or add water quality objectives. Since its inception in 1980, a Science Advisory Board through its Aquatic Ecosystem Objectives Committee (AEOC) has developed seven new objectives and revised thirteen existing objectives which have been recommended by the IJC to the two governments.

AGENCY COMMITMENT TO WATER QUALITY OBJECTIVES

The Parties are required by the Agreement to urge regulatory jurisdictions to "ensure" that standards or other legal instruments are "consistent" with the objectives.

The Aquatic Environment Objectives Committee considers the Agreement Objectives to be the goals only when and where they have been exceeded in the system. They are not such where the existing water quality is better than the objective limits prescribed.

ACHIEVEMENTS

- Reductions in phosphorous loadings to the Great Lakes are being achieved;
- Seven new objectives proposed to the IJC; thirteen existing objectives revised;
- Biological surrogate indicators of ecosystem quality and goals towards which to strive have been recommended to the IJC. The background document recommending a general ecosystem objective has been prepared setting forth a methodology for assessing the achievement of a specific, cold water oligotrophic ecosystem objective.

POPLAR RIVER BILATERAL ARRANGEMENT

Water Quality Objectives were proposed by the Poplar River Water Quality Board, IJC, in 1979. The IJC chose to modify the proposed objectives and recommended that further work was required in order to establish the multi-purpose objectives. Although the recommendations of the IJC still remain to be accepted by governments, a bilateral arrangement has been negotiated which has adopted two objectives most crucial to the protection of agricultural water uses downstream in the U.S.A. The Poplar River Bilateral Committee, which oversees the monitoring arrangement, has also adopted for its own use, the proposed multi-purpose water quality objectives of the Poplar River Water Quality Board. The Committee reports annually to governments concerning compliance with respect to these objectives.

The objectives proposed by the IJC are flow weighted water quality objectives primarily because the productivity of irrigated lands in the

U.S.A. depend to a considerable extent on the quality of the applied water. Furthermore, a short (three month moving average) and long (five year moving average) term water quality objective philosophy was applied. Concentrations in the applied water is not so much the issue as it is the total amount of boron and TDS applied to the crops during the irrigation period. The Multi-purpose Objectives proposed by the Poplar River Board are related to instantaneous concentrations of the constituents in a grab sample of water.

AGENCY COMMITMENT TO WATER QUALITY OBJECTIVES

The Saskatchewan Water Corporation and the Environment departments of Saskatchewan and Canada have endorsed the use of the objectives to guide them in recognizing potential water quality issues at the International Boundary of the East Poplar River.

Saskatchewan Power Corporation monitors with respect TDS and Boron to ensure compliance with the IJC objectives and have indicated the willingness to regulate flow should these parameters become a problem during the irrigation period when the IJC objectives apply.

The objectives have appeased the downstream agencies. They would like to have the objectives formalized into international standards, which from Canada's point of view, is not the intended purpose of the objectives nor is it desirable. However, Saskatchewan and Montana may wish to promulgate stream standards within their respective jurisdictions.

ACHIEVEMENTS

- Saskatchewan Environment has used the objectives to establish licensing requirements to SPC;
- The flow weighting has demonstrated to this point in time that existing concentrations/loadings for boron and TDS are not yet a concern to agricultural interests downstream;
- Public hearings into the operation of the plant (held during the EIA's) have demonstrated a public endorsement of water quality objectives. Adherence to the objectives provides a feeling of security to downstream interests.

SAINT JOHN RIVER, NEW BRUNSWICK

Canada and the United States have been working cooperatively towards resolving the water quality problems of the transboundary Saint John River. Water quality objectives have played an important role in guiding the development of pollution control measures. Specifically, the purpose of the objectives was to contribute to the protection and enhancement of the quality of the river's water so that it may meet the requirements of established uses and protect the life systems it supports. The objectives apply to the boundary portion of the river, tributaries which cross the international boundary, and tributaries to the boundary portion of the main stem.

The selection of parameters for objectives was influenced by the existing or predicted patterns of settlement and land use and whose levels were amenable to local control. The historical data and their variability were used in the development of the objectives. The objectives concept incorporates both a safe and an alert level concept predicated on

lethality and the need to mount timely investigations, to ensure protection of the designated water uses, when limits are exceeded.

AGENCY COMMITMENTS TO WATER QUALITY OBJECTIVES

The state of Maine's commitment to meeting the objectives is well reflected in its upgrading and new construction of pollution control structures in eleven cities (industries: potatoe, wood mills, land fill sites; Municipalities: secondary sewage treatment systems, zero discharge with spray irrigation, solid waste incinerators . . .).

The Province of New Brunswick has upgraded or constructed similar pollution controls in nine population centres focussing on primarily sewage systems but also industrial discharges.

The Province of Quebec has constructed a collector system for three towns.

ACHIEVEMENTS RELATED TO WATER QUALITY OBJECTIVES

- Since 1972, source pollutants have been reduced by 88% in terms of BOD loading and by 82% in terms of suspended solids discharged.
- The effect of the changes are marked by improvement in dissolved oxygen levels in the upper reach of the Saint John River.
- The restoration of the salmon fishery to the upper reaches of the Aroostook River is a direct beneficiary of objectives (in part) and agency commitments.

PRAIRIE PROVINCES WATER BOARD

In order to help identify, avoid and resolve interprovincial water quality conflicts on the major eastward flowing streams, the PPWB has adopted water quality objectives. These objectives of 1973 are currently being updated in view of new scientific information and the unique characteristics of each monitoring location. The Proposed Indicators, as they are presently called, identify the quality of water which the downstream jurisdiction can expect in support of its designated present and foreseeable water uses. The Committee on Water Quality has indicated that the Indicators would normally be used by the upstream province to make water quality management and planning decisions that are compatible with downstream water needs and which would provide for the equitable sharing of the resource.

The site specific indicators incorporate the concept of water quality expectations over both a short- and long-term basis. The Short Term Indicator considers maximum acceptable concentrations based on acute toxicity, a deviation from which would identify a possible water quality concern and prompt investigative action if deemed warranted. The Long Term Indicator considers chronic toxicity, seasonality of the parameter, and stability of the water quality baseline. An excursion of a Long Term Indicator identifies a possible change in water quality over the long term.

The PPWB recognizes that the Provinces are the custodians of the water resources and may manage this resource to assimilate wastes as long as water uses in downstream provinces are not impaired. Furthermore, water quality apportionment is a necessary consideration in equitably sharing water resources for all water use purposes. The Short Term Indicator encompasses the apportioning of the difference between the maximum acceptable concentration of a parameter and the natural quality (taken as the mean over the long term data base).

AGENCY COMMITMENT TO WATER QUALITY OBJECTIVES

The Member agencies to the PPWB have indicated their ongoing cooperative and active support to the PPWB Master Agreement on Apportionment. Pollution control agencies have responded timely to excursions of water quality objectives/indicators with investigative follow-up action. Saskatchewan and Alberta have used the Indicators in the development of effluent regulations for industry and the preparation of EIS guidelines.

ACHIEVEMENTS RELATED TO WATER QUALITY OBJECTIVES

The most significant achievement relates to the negotation of water quality objectives or Indicators which provide all jurisdictions involved, with a statement of the water quality that can be expected at the interprovincial crossings of the PPWB stations. This has been invaluable in reconciling differences, establishing EIS guidelines and

meeting the surveillance and monitoring responsibilities of the Board. Excursions resulted in the identification of potential concerns such as eutrophication and 2,4-D concentrations of surface waters. Excursions have directly contributed to Provincial decisions to forewarn downstream water users of advancing poor water quality. The Rationale Documents being prepared in support of the Proposed Water Quality Indicators will provide an authoritative regional reference regarding the quality of the major waterways in Prairie Canada and the quality expectations for the protection of the designated water uses.